

Description OF EP0728509

The invention concerns a device for separating bubbles from medical liquids, in particular for separating bubbles from blood, with an essentially circle-cylindric chamber, a Einlautstutzen and a discharge connecting piece in accordance with the German patent application P 43 29 385.9. Since devices can find for separating bubbles from medical liquids also for separating other gases than air use, such air separators are called also degassing device. If blood is taken from the natural blutkreislauf of a patient and led by an artificial blutkreislauf, it is necessary to separate the blood from possibly contained gases to before it is supplied again to the body of the patient. This continues to occur for example with the Zellseparation in the context of the Autotransfusion of blood with operations, with hemodialysis or Haemofiltration, as well as with combinations of these treatment techniques. In particular with degassing of blood the problem places itself that the separation must take place from bubbles on the one hand with large reliability, since possibly in the blood contained bubbles can lead to the death of the patient on the other hand the air separator regarding its mechanical characteristics and the training flow form must be so constituted that damages of the blood components are avoided. For a small Blutschaedigung a good Auswaschverhalten of the air separator is desirable, which accompanies with material-laterally smooth surfaces as well as with an aerodynamically clean continuous organization of the flow courses, so that adhering of blood corpuscles at surfaces of the air separator and thus a Konglomeration are avoided of blood corpuscles will for a small Blutschaedigung further short retention times of the blood in the air separator favorably, without worsening however the luftabscheidung as such. Furthermore is a small fuellvolumen of advantage. A well-known device for separating bubbles from liquids is from GB 2,063,108 well-known. The well-known air separator exhibits an essentially circle-cylindric trained, perpendicularly arranged chamber with an inlet connecting piece and an outlet nozzle. The inlet connecting piece is in such a manner arranged at the upper end of the chamber that the liquid which can be degassed occurs essentially tangential in the range of the outside extent the chamber. Due to the tangential introduction the liquid which can be degassed flows first on a circular flow course, which is overlaid however by the entire current by the senkrechte chamber, so that the liquid again from the chamber withdraw-withdrawing those produce the chamber in a schraubenlinienfoermigen flow course flowed through and at the lower end from the tangential arranged discharge connecting piece circular movement portions of the liquid flow thereby centrifugal energy, which develop in the liquid differences of pressure, so that seal less, i.e. lighter bubbles are pushed for the center of the chamber and along the longitudinal axis of the chamber to ascend, until they are exhausted by the bleed bore. The air separators inserted use the running of hospitals should fasten themselves easily and let without larger expenditure into hose lines already existing insert. Therefore it is aimed at that the inlet connecting piece is arranged not tangential, but in longitudinal direction of the chamber. If the inlet connecting piece is located on the longitudinal axis of the chamber, let yourself the air separator for example after cutting an existing hose open in these begin, without the hose routing would have to be changed. Furthermore the hose routing without unnecessary loops can take place. Of an air separator for the treatment when using blood it is necessary furthermore that the air separator is exchanged in particular after a certain assignment and with a patient change. Since a cleaning, which meets the hygienic requirements in the running of hospitals, of the expenditure is not to be represented, the air separator should be trained as throw-away articles. In accordance with the main registration an air separator is suggested, which exhibits downstream the inlet pipe a flow guidance construction unit, which essentially consists of a rotationally symmetric base, whose is

defined the liquid flowing in turned outside surface geometrically by rotation of a curve section around the longitudinal axis of the chamber and is provided with guide vanes. Furthermore is suggested arranging parallel to the first flow conducting surface a second conducting surface under training of a multiplicity of flow channels. The invention is the basis the task to train a device as separating bubbles from medical liquids, which maintains on the one hand the advantages of the schraubenlinienfoermigen flow guidance and exhibits on the other hand an inlet connecting piece lying in the longitudinal axis of the air separator, in such a manner that their production is simplified. The solution of the task takes place with the characteristics indicated in the patent claim 1. During the device according to invention for separating bubbles from medical liquids that exhibits downstream the inlet pipe or connection arranged flow guidance construction unit for producing the schraubenlinienfoermigen flow course a central flow pipe arranged in longitudinal direction of the chamber, which changes preferably two flow conduit tubes, which extend in each case in a space curve from the chamber longitudinal direction into one tangential to the wall of the chamber running direction into several. Will led the liquid flowing in in the flow conduit tubes first in radial direction outward, in order to be then returned in such a manner that the liquid leaks out the flow conduit tubes in one essentially tangential to the wall of the chamber running direction, whereby the desired schraubenlinienfoermige current is induced. The flow guidance construction unit of the device according to invention, which can be called also intake distributors, can be made due to its training with the flowing in pipes in a simple manner as spritzgussteil of conventional, preferably transparent plastic in large numbers of items. The flow construction unit makes possible it to plan an inlet pipe arranged in longitudinal direction the chamber without without the advantages of the basic concept to train i.e. the current in the chamber schraubenlinienfoermig must be done. The central conduit tube of the flow guidance construction unit can be attached thereby at the inlet pipe of the chamber, be suitably assigned e.g. in the tubular inlet connecting pieces. In addition, it is possible that the central flow pipe is a einstueckiger component of the inlet pipe. With the flow conduit tubes the flow guidance construction unit makes a continuous possible, impacts to a large extent avoiding flow guidance, so that in the liquid which can be degassed an even current profile is produced. This leads to low and even shear stresses, so that separating of bubbles from blood is connected with a minimum Blutschaedigung. The flow guidance construction unit exhibits preferably two flow conduit tubes, which are in such a manner arranged that their openings point into opposite directions. It is reached that the two currents do not overlay and turbulences within the range of the flow construction unit are avoided. In order to simplify the production of the flow guidance construction unit further, consists this favourable-proves of two sections. The first section preferably covers the central flow pipe and the upper half of the flow conduit tubes and the second section the lower half of the flow conduit tubes. Alternatively it is possible in addition, to build the flow construction unit up from two longitudinal halves. The two sections can be manufactured in the injection moulding procedure in appropriate forms particularly simply. Later the sections under training of the flow guidance channels can be built up, in which the liquid is returned. For this one half of the flow guidance construction unit is appropriately provided with pins, which can do seize-seizing those when squeezing the two sections together into appropriate recesses of the other half sections are also with one another stuck together. In the following with reference to the designs a remark example of the device according to invention is described for separating bubbles from medical liquids. Show: Fig. 1 the air separator in partly cut representation, Fig. 2 the flow guidance construction unit of the air separator in the side view, Fig. 3 the upper and lower section of the flow

construction unit in the side view before building, Fig. 4 an opinion of the lower section of the flow construction unit from the direction of the arrow IV of Fig. 3, Fig. 5 the lower section of the flow guidance construction unit of Fig. 4 in the plan view, and Fig. 6 the flow guidance construction unit in partly cut, perspective representation, built up from two longitudinal halves. Fig. 1 shows the perpendicularly arranged air separator in partly cut representation. The air separator exhibits an essentially circle-cylindric chamber 1, which is locked at their upper end with a cover 2, which is provided with a cylindrical flange 3 and a circulating, the wall 4 of the container 1 spreading edge 5. In the center of the cover 2 an inlet pipe 6 is for the connection of a not represented supply line and at the lower end of the container is arranged a discharge connecting piece 7 for the connection of a not represented drain line, which in each case exhibits an inside diameter, which forms a tight fit together with the diameter of the connection tubes which can be inserted. The inlet pipe 6 is einsteckig trained with the cover 2. Beside the inlet pipe 6 a further connecting piece 8 is for the connection of a pressure oil hose at the lid 2. Downstream the inlet pipe 6 a flow guidance construction unit 9 is arranged, which is described in the following with reference to the Fig. 2 to 5 in detail. The flow guidance construction unit 9 exhibits a central, flow pipe 10 with a central flow channel 11 arranged in longitudinal direction of the chamber, which is assigned suitably in the inlet pipe 6 of the lid 2. The central flow pipe 10 changes into two flow conduit tubes 12, 13, which a einsteckiger component of the central flow pipe 10 is symmetrically trained and concerning the longitudinal axis of the flow pipe. To the elucidation Fig. 1 points the upper section of the central flow pipe 10 in cut representation, while the lower section of the central flow pipe 10 and the two flow conduit tubes 12, 13, i.e. the lower part of the flow guidance construction unit extend 9, in perspective representation represented be-being those flow conduit tubes 12, 13 on the basis of the central flow pipe 10 arranged in longitudinal direction of the chamber after both sides in a space curve screw-shaped into one essentially tangential to the wall of the chamber 1 running horizontal direction. The openings 14, 15 of the two wing-like which are away flow conduit tubes 12, 13 point thereby into opposite directions. The flow conduit tubes exhibit an essentially continuous duct cross section, which is about half as large as the cross section of the central flow channel 11 over their length. By the special training of the flow guidance construction unit 9 toward the upper arrow liquid in the two flow conduit tubes 12, 13, flowing in by the inlet pipe 6 into the central flow pipe 10, it is radially outward led and additionally in such a way returned that the liquid flows with the withdrawal from the flow conduit tubes in one essentially tangential to the wall of the chamber running, horizontal direction (Fig. 1). The vertical current is thus returned into a horizontal circulation flow. Thereby a schraubenlinienfoermige current is induced, whereby the circular portions develop a difference of pressure, which leads to the fact that the bubbles are pushed toward longitudinal axis and due to their smaller density to ascend upward. The ascended bubbles form in the top of the chamber an air cushion. General as small a flow rates as possible are to be aimed at, in order to avoid a renewed supply of air at the surface of the liquid. Furthermore the outlets 14, 15 of the flow construction unit should be arranged 9 in sufficient distance to the cover 2 and/or the air cushion forming underneath the cover. After the blood flowed from above downward into schraubenlinienfoermigen courses by the chamber 1, it flows off by one in Fig. 1 filterkerze named the reference symbol 16 and then by the discharge connecting piece 7 for further use. Fig. 1 shows a coaxial arrangement of in and discharge connecting pieces 6, 7. In addition, it is possible that only the inlet pipe 6 in chamber longitudinal direction is arranged and the discharge connecting piece 7 is attached to the chamber in tangential direction. Of technical reasons the flow guidance construction unit consists 9 of

two sections 9', 9', which are represented in Fig. 3. The first section 9' covers the central flow pipe 10 and the upper half of the two flow conduit tubes 12, 13, while the second section 9' covers ' the lower half of the two flow conduit tubes 12, 13. Thus the two sections 9', 9' ' after the manufacturing engaging to build up leave themselves, are intended at the lower half of two pins 17, 17 ', which into appropriate recesses 18, 18 ' at the upper section to reach and both parts together firmly hold. Fig. the flow guidance construction unit built up from two longitudinal halves shows 6 in partly cut perspective representation. The flow guidance construction unit is divided in longitudinal direction without Hinterschneidungen. The first section 9' covers the one longitudinal half of the central flow pipe 10 and one half of the flow conduit tubes 12, 13 and the second section 9' ' in each case covers the other longitudinal half of the central flow pipe 10 and in each case the other half of the flow conduit tubes 12, 13. The cut line is characterized in Fig. 6 by arrows. With this execution form the two sections do not exhibit pins and/or recesses, but the two sections stuck together with one another. All parts of the air separator according to invention are preferably made in the injection moulding procedure of transparent plastic, so that optical control of the level and the flow pattern is at any time possible. The training according to invention of the flow guidance construction unit creates an air separator, that due to a possible coaxial arrangement of intake and discharge connecting pieces into an existing hose system to insert in a simple manner leaves themselves and permits a manufacturing in large numbers of items at only small technical expenditure.

Claims OF EP0728509

1. Device for separating bubbles from medical liquids, in particular blood, with an essentially circle-cylindric chamber (1), an inlet pipe (6) and a discharge connecting piece (7), thereby characterized that the inlet pipe (6) is arranged in longitudinal direction of the chamber (1), and that to the inlet pipe (6) a flow guidance construction unit (9) with a central flow pipe (10) running in longitudinal direction of the chamber (1) is attached, that into at least two flow conduit tubes (12, 13) turns into, which extend in each case in a space curve from the chamber longitudinal direction into one essentially tangential to the wall of the chamber running direction.
2. Vorrichtung according to requirement 1, by it characterized that the flow guidance construction unit (9) exhibits two flow conduit tubes (12, 13), their openings (14, 15) to opposite directions point.
3. Device according to requirement 2, by the fact characterized that the first and second flow conduit tube (12, 13) concerning the longitudinal axis of the central flow pipe (10) it is symmetrical.
4. Device after one of the requirements 1 to 3, by the fact characterized that the flow guidance construction unit (9) consists of at least two sections (9', 9'').
5. Device according to requirement 4, by the fact characterized that the first section (9') covers the central flow pipe (10) and the upper half of the flow conduit tubes (12, 13) and the second section (9'') the lower half of the flow conduit tubes (12, 13).
6. Device according to requirement 4, by the fact characterized that the first section (9') covers one half of the central flow pipe (10) and one half of the flow conduit tubes (12, 13) and the second section (9'') in each case in each case the other half of the central flow pipe (10) and the other half of the flow conduit tubes (12, 13).
7. Device after one of the requirements 4 to 6, by the fact characterized that the two sections (9', 9'') of the flow guidance construction unit are build upable (9).
8. Device according to requirement 7, by it characterized that a section (9', 9'') of the flow construction unit (9) is provided with pins (17, 17'), those in appropriate recesses (18, 18') of the other section (9', 9'') it sits.
9. Device after one of the requirements 1 to 8, by the fact characterized that the chamber (1) is essentially perpendicularly arranged.